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Andreev bound states in a semiconducting nanowire Josephson junction, Part II: Quantum jumps and Fermion parity switching[1] M. HAYS, G. DE LANGE, K. SERNIAK, Department of Applied Physics, Yale University, New Haven, USA, D.J. VAN WOERKOM, QuTech and Kavli Institute of Nanoscience, Delft University of Technology, Delft, The Netherlands, J.I. VÄYRYNEN, B. VAN HECK, U. VOOL, Department of Applied Physics, Yale University, New Haven, USA, P. KROGSTRUP, J. NYGÅRD, Center for Quantum Devices and Station Q Copenhagen, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark, L. FRUNZIO, Department of Applied Physics, Yale University, New Haven, USA, A. GERESDI, QuTech and Kavli Institute of Nanoscience, Delft University of Technology, Delft, The Netherlands, L.I. GLAZMAN, M.H. DEVORET, Department of Applied Physics, Yale University, New Haven, USA — Proximitized semiconducting nanowires subject to magnetic field should display topological superconductivity and support Majorana zero modes which have non-Abelian braiding statistics. The conventional Andreev levels formed in such wires in the absence of field are a precursor to these exotic zero modes. The fermion-parity switching time of Andreev levels sets a lower bound on the bandwidth required for experiments aimed at harnessing non-Abelian braiding statistics. We demonstrate the observation of quantum jumps between even and odd-parity states of an individual Andreev bound state in a non-topological junction, providing a direct measurement of the state populations and the parity lifetime.

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Max Hays
Department of Applied Physics, Yale University, New Haven, USA

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